University of Bremen

Master of *Neurosciences*

Course Catalogue (Modulhandbuch)

Master of Neurosciences - The Board of Examiners

c/o Prof. Dr. M. Koch

University of Bremen

POB 330440

28334 Bremen, Germany

The Master of *Neurosciences* Program

The Master of *Neurosciences* at the University of Bremen is a multidisciplinary study program for European and Non-European students with a background in biology, physics, psychology, informatics or a related subject. All courses are taught in English.

Curriculum

The program consists of four semesters (2 years) including the thesis. Starting with basic modules in the first semester, already in the second semester the students are encouraged to chose disciplines for specialisation in various *Advanced studies* modules. In the third semester, the students perform two Lab rotations (Internships) in labs in Bremen or abroad. The fourth semester is devoted to the thesis work.

Aims

The Master of *Neurosciences* program will provide you with an ideal balance between basic knowledge and personal specialisation preparing you for an academic career in the neurosciences. In addition to the theoretical and practical knowledge, the program also trains your communication and social skills.

Time scheme and overview of the curriculum of the Master of *Neurosciences* at the University of Bremen

Type of course: **(L) = Lecture (S) = Seminar (E) = Exercise (T) = Tutorial (LC) = Lab course (Internship)**
C/E: **Compulsory/Elective**
CP: **Credit points**

Module	C/E	Title	CP	Corresponding courses	Semester
401-1	C	Cellular and Molecular Neurosciences and Mentoring	6	Neurochemistry L	First semester
				Neuropharmacology I S	First semester
402	C	Systemic Neurosciences	6	Comparative Neuroanatomy L E	First semester
				Cognitive Neurophysiology L	First semester
403-1	C	Theoretical Neurosciences	6	Computational Neuroscience I L E	First semester
				Statistical Methods L E	First semester
				Computational Neuroscience II L E	Second semester
404	C	Clinical Neurosciences	6	Clinical Neuropsychology L + E	First semester
				Clinical Neurology L + S	First semester
414	C	Programming	3	Programming L E	First semester
415	C	Laboratory Animal Science	3	Laboratory Animal Science L E	First semester
	C	Introductory week	3	Basic concepts and methods in neuroscience L T	Second semester
406	E	Neuro-and Electrophysiology	9	Advanced Studies 1 in Neuro-and Electrophysiology S E	Second semester
407	E	Neuropharmacology II	9	Advanced Studies 1 in Neuropharmacology II S E	Second semester

Module	C/E	Title	CP	Corresponding courses	Semester
408	E	Optogenetics and Neuroscience methods	9	Advanced Studies 1 in Optogenetics and Neuroscience methods S E	Second semester
410	E	Experimental Neuropsychology	9	Advanced Studies 1 in Experimental Neuropsychology L E	Second semester
411	E	Cognitive Psychology and Electroencephalography	9	Advanced Studies 1 in Cognitive Psychology and EEG L S E	Second semester
412	E	Structural and Functional Neuroimaging	9	Advanced Studies 1 in Structural and Functional Neuroimaging L S E	Second semester
413	E	Neurophysics	9	Advanced Studies 1 in Theoretical Neurosciences, data analysis and modelling L S E	Second semester
501	E	Lab Rotation 1	15	Advanced Studies 2 (Internship)	Third semester
502	E	Lab Rotation 2	15	Advanced Studies 2 (Internship)	Third semester
	C	Master Thesis	30	Master Thesis and Colloquium	Fourth semester
				Supervisory Seminar	Fourth semester
Total			**120**		

* Students chose three out of seven Advanced studies (Modules 406, 407, 408, 410, 411, 412, 413)

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Course catalogue (Modulhandbuch) MSc Neurosciences

Module 401-1	
Title	Cellular and Molecular Neurosciences and Mentoring
Coordinator	Prof. Dr. M. Koch
Course(s)	1. Neurochemistry 2. Neuropharmacology
Type	1. Lecture 2. Seminar
Total Number of Hours per Semester & Course	1. 2 SWS 2. 2 SWS
Compulsory/ Elective	Compulsory
Study Programme	Master of Neurosciences
Duration	1. Three weeks 2. Three weeks
Term	First semester (Winterterm)
Student Workload	CPs: 6
	Elaboration: a) Attendance: 1. Lecture: 28 hours 2. Seminar: 28 hours b) Preparation for exams, seminar talk: 124 hours
Prerequisites of Acceptance	Enrolled Graduate M. Sc. Students
Frequency	Annual
Language	English

Learning Objectives	Lecture and seminar: In this module, students will become acquainted with the basic principles of neurobiochemistry (energy metabolism, transmitter synthesis as well as mechanisms of transmitter degradation), the processes of signal transmission at chemical synapses (including second messenger systems), categorization and function of transmitter receptors and transporters. They will also learn about the functional neuroanatomy of transmitter systems of mammals, the basics of neuropharmacology (blood-brain barrier, pharmacological kinetics as well as pharmacological dynamics), mode of action of relevant psychotropic drugs. Function of neurotrophic factors, neuromodulators and –peptides. The seminar is held in conjunction with module 404 (Clinical neurology) Mentoring: Students select a mentor from the teaching staff with whom they meet regularly and get counselling towards the development of a personal study profile regarding professional qualifications
Competency	Students understand the basic principles of brain chemistry and the significance of those principles for the evaluation of clinical disorders and relevant pharmacological therapies They give a seminar talk on a topic related to the pharmacotherapy of a selected neuropsychiatric disorder Mentoring: Students develop the competency in planning course and research portfolios matching their career goals
Forms of Examination / Course Achievements	1. Written exam 2. Seminar talk
Literature	Copper, JR; Bloom, FE; Roth, RH (2003). *The Biochemical Basis of Neuropharmacology*. 8th Edition, OUP Siegel, GJ et al. (2006) *Basic Neurochemistry*. Academic Press, Amsterdam Selected, recent reviews

Module 402	
Title	Systemic Neurosciences
Coordinator	Prof. Dr. O. Masseck
Course(s)	a. Comparative Neuroanatomy b. Cognitive Electrophysiology
Type	a. Lecture, Exercise b. Lecture
Total Number of Hours per Semester & Course	a. 2 SWS b. 2 SWS
Compulsory/ Elective	Compulsory
Study Programme	Master of Neurosciences
Duration	1 semester
Term	First semester (Winterterm)
Student Workload	CPs: 6
	Elaboration: Attendance 4 SWS Experimental Neuroanatomy Lecture 18 hours Experimental Neuroanatomy Exercise 10 hours Cognitive Electrophysiology 28 hours Home studies (preparation, revision) 40 hours Reading 50 hours Exam preparation 34 hours
Prerequisites of Acceptance	Enrolled Graduate M. Sc. Student
Frequency	Annual
Language	English

Learning Objectives	a. Lecture: Principal organization of vertebrate brains Understanding of cellular components of the brain Relationship between structure and function of brains Basics of comparative anatomy of vertebrates Evolution of nervous systems and brains a. Exercise: Microscopic analysis of sections of vertebrate brains (rat, bird, amphibian, fish), Experience with stereotaxic atlas (books and digital versions) of different vertebrate brains and on a human brain model b. Architecture and function of the visual system Parallel processing in the visual system Neuronal coding Methods for investigation of neuronal information processing Neuronal mechanisms of cognitive processes
Competency	a. Students are familiar with the *bauplan* of the brain and its modifications. Students handle anatomical terms and are able to assign brain areas on brain sections and in brain models. Students understand the functional principles of natural neuronal networks. Students know the major functional systems in the brain and are able to detail the associated structures. b. Students have acquired knowledge on the functional anatomy of the visual system and on characteristic response properties of related neurons. Students have an overview of the principal methods of systemic neurophysiology and comprehend the neuronal correlates of cognitive processes.
Forms of Examination / Course Achievements	Written or oral exam
Literature	Galizia G, Lledo PM (2013) Neurosciences - From Molecule to Behavior: A University Textbook. Springer. Kandel ER, Schwartz JH, Jessell TM, Siegelbaum SA, Hudspeth AJ (2012) Principles of Neural Science. Mac Graw Hill. Nieuwenhuys R, ten Donkelaar HJ, Nicholson C (1998) The Central Nervous System of Vertebrates. Volumes 1-3. Springer. Squire LR, Berg D, Bloom FE, du Lac S, Ghosh N, Spitzer NC (2012) Fundamental Neuroscience. Elsevier. Selected, recent reviews

Module 403-1	
Title	Theoretical Neurosciences
Coordinator	Prof. Dr. Klaus Pawelzik
Course(s)	Statistical Methods **(SM)** Computational Neuroscience I **(CNS I)**: Neurons, Coding, and Dynamics Computational Neuroscience II **(CNS II)**: Synapses, Networks, Computation, and Memory
Type [1]	Lecture/Exercises
Total Number of Hours per Semester & Course	2 SWS
Compulsory/ Elective	Compulsory
Study Programme	Master of Neurosciences
Duration	2 semesters
Term	First winter term **(SM, CNS I)** & first summer term **(CNS II)**
Student Workload	CPs: 6 **(2 CP for SM / 2 CP for CNS I / 2 CP for CNS II)**
	Elaboration (per course): Attendance 2 SWS (Lecture+Exercises) Lecture 14 hours Exercises 14 hours Home studies (preparation, revision, reading) 22 hours Exam preparation 10 hours
Prerequisites of Acceptance	Enrolled Graduate M. Sc. Student
Frequency	Annual
Language	English
Learning Objectives	**Statistical Methods:** The course will start with rehearsing methods from descriptive statistics, in particular on concepts important for understanding neuronal data. Subsequently, we will focus in parallel on methods useful for investigating the brain as an information-processing system, and on methods needed to analyze behavioral or neural data (e.g., EEG, fMRI, Electrophysiology). Descriptive statistics: discrete and continuous probability distributions (normal, Poisson, Bernoulli), mean, variance, kurtosis and higher moments autocorrelation, cross-correlation, covariance Probability calculus: Bayes formula and Bayesian estimation, risk, likelihood ratio, objective functions, ML/MAP estimation, receiver operator characteristics, discrimination, classification

[1] **Lecture / Course / Tutorial or Lab Course / Project**

	Statistical tests (non-parametric/parametric) and models: Wilcoxon, Friedman, Kolmogorov-Smirnov, t-test, ANOVA (basic, multivariate and factorial), surrogate data and bootstrap procedures, regression and statistical modelling **Computational Neuroscience I and II** Participants will be introduced to fundamental concepts in Computational Neuroscience. In the first term, we will study basic encoding and decoding schemes, analysis of neural signals, and the dynamics of single neurons. In the second term, we will focus on synapses and neural networks, and study emergent phenomena such as computation and classification, learning and memory, pattern formation, and synchronization. In detail, these topics include: **CNS I:** spikes, rates, correlations, spectral analysis, LNP/GLM models, receptive fields, reverse correlation, stimulus reconstruction, membrane potential dynamics, neuron models (integrate-and-fire, Fitzhugh-Nagumo, Hodgkin-Huxley) **CNS II:** action potential propagation, synaptic transmission, Hebbian learning and STDP, population dynamics and spiking networks, perceptrons, Hopfield model, pattern and map formation, introduction to machine learning techniques
Competency	**Statistical Methods:** In this course, you will acquire the necessary skills to perform analysis of neural or behavioral data in a lab situation. In particular, you will learn how to plan experiments yielding meaningful statistics, and how to select and to apply appropriate statistical tests. In parallel, you will understand how to compute with probabilities and how to perform inference and estimation on noisy data. Hereby you acquire the competency to study encoding and decoding of information in the brain. **Computational Neuroscience I and II** Students will develop the competency to understand and to use basic mathematical methods from Computational Neurosciences, and they will gain knowledge about paradigmatic models and theories in that field. These competencies will be trained in exercises where students will apply analytical methods to study neural dynamics and information processing in the brain. Skills acquired in this course will be essential for working in a neuroscience lab, in particular for analyzing data, testing theories, and performing simulations of brain function. Basic knowledge in elementary calculus (functions, equation solving, differentiation, integration, probability theory) is required. An optional, two-week course for rehearsing these concepts is provided prior to the start of this lecture.
Forms of Examination / Course Achievements	For each course, one written exam. All three exams have to be passed for obtaining the 6 CP for the full course **(SM + CNS I + CNS II)**.

Literature	**Statistical Methods:** • Kass, R. E., Eden, U., & Brown, E,. (2014). Analyses of Neural Data. Springer: NY. ISBN: 978-1-4614-9601-4 • Crawley, M. J. (2005). Statistics: An Introduction Using R. John Wiley and Sons: Chichester, GB. ISBN: 0-470-02297-3 • Klein, D., & Dabney, A. (2013). The Cartoon Introduction to Statistics. Hill and Wang: NY. ISBN: 978-0-8090-3366-9. • Updated handouts (will be provided frequently during the respective winter term) **Computational Neuroscience:** • Abbott and Dayan, Theoretical Neurosciences, MIT Press 2005. • Hertz, Krogh and Palmer, Introduction to the Theory of Neural Computation, Perseus, 1991. • Wikipedia, various articles.

Module 404	
Title	Clinical Neurosciences
Coordinator	Prof. Dr. Dr. M. Herrmann
Course(s)	1. 404a Clinical Neuropsychology 2. 404b Clinical Neurology
Type	1. Lecture / Hands-on Training (Exercises, E) 2. Lecture / Seminar
Total Number of Hours per Semester & Course	1. 3 SWS 2. 2 SWS
Compulsory/ Elective	Compulsory
Study Programme	Master of Neurosciences
Duration	Six weeks
Term	First semester (Winterterm)
Student Workload	CPs: 6
	Elaboration: Attendance: Clinical Neuropsychology 28 hours Clinical Neurology 28 hours Hands-on training 14 hours Home studies (preparation, revision) 52 hours Reading 32 hours Exam preparation 40 hours
Prerequisites of Acceptance	Enrolled Graduate M.Sc. Students
Frequency	Annual
Language	English

Learning Objectives	404a: Introduction into disorders of major cognitive domains (attention, memory, executive functions, visuoperceptive, -constructive, -cognitive function, emotion and affect …) and their underlying neuropathological conditions. Presentation of standard assessment procedures and diagnostic tools. Lectures will be accompanied by a hands-on training to give students the opportunity to practice assessment procedures right after teaching. 404b: Brief introduction into epidemiology / pathophysiology, symptoms / medical history, differential diagnosis, and treatment / rehabilitation of disorders of the central nervous system (dementia and other degenerative disorders (Parkinson's Disease, Huntington's Disease), stroke, traumatic brain injury, multiple sclerosis, and epilepsy). Teaching in this course will be combined with the "Neuropharmacology" seminar (module 401b) with its focus on pharmacological aspects of drug treatment in the above mentioned CNS disorders.
Competency	Students will get familiar with various neuropsychological syndromes in humans both with respect to the clinical condition and diagnostic and therapeutic issues (404a). Students will get a basic knowledge of the major neurological conditions/brain disorders in humans leading to disturbances of cognitive functions as well as of the underlying pathophysiology, and diagnostic and treatment options (404b).
Forms of Examination / Course Achievements	Written exam / E-Exam
Literature	Gazzaniga, M.S., Ivry, R., & Mangun, G.R. (Eds.) (2008). *Cognitive Neuroscience: The Biology of the Mind.* 3rd ed. New York: Norton. Jeannerod, M. Kolb, B. & Wishaw, I. Q. (2008). *Fundamentals of Human Neuropsychology*. 6th ed., New York: W. H. Freeman & Co. Ropper, A.H. & Brown, R.H. (2005) *Adams and Victor's Principles of Neurology*. Part 1 New York: McGraw Hill Book. Co.

Module 414

Title	Programming
Coordinator	Prof. Dr. Klaus Pawelzik
Courses	Programming
Type [2]	Lecture/Exercises
Total Number of Hours per Semester & Course	2 SWS
Compulsory/ Elective	Compulsory
Study Programme	Master of Neurosciences
Duration	1 semester
Term	First winter term
Student Workload	CPs: 3
	Elaboration: Attendance 2 SWS Lecture 14 hours Exercises 14 hours Home studies (preparation, revision) 28 hours Reading 14 hours Exam preparation 20 hours
Prerequisites of Acceptance	Enrolled Graduate M. Sc. Student
Frequency	Annual
Language	English

Learning Objectives	Objectives of this course are (I) to learn basic programming concepts using Matlab, and (II) to apply these concepts to perform data analysis and simulations of neural systems. These include:
	for (I): binary representations, variables, expressions, control of execution flow, functions, file and graphical input/output, data formats, arrays, vectors, linear algebra operations
	for (II): handling spikes and spike trains, computing receptive fields, statistical analysis of real neural data, numerical integration and differentiation, solving differential equations and simulating neurons and neural networks

Competency	Students will develop the skills to solve simple numerical problems by using a programming language like Matlab. In particular, they will learn how to organize, preprocess, and analyze neuroscientific data, and how to simulate neurophysiological processes and networks on a computer. This course will provide the competencies to successfully work with computers and lab equipment in the Advanced Studies, and in subsequent stages of the Master programme.

[2] **Lecture / Course / Tutorial or Lab Course / Project**

Forms of Examination / Course Achievements	Written exam at the computer.
Literature	Lecture Script The Matlab Primer, Third Edition (http://www.math.toronto.edu/mpugh/primer.pdf) Numerical Recipes in C++, Cambridge University Press, Third Edition 2007. Wikipedia, various entries.

Module 415	
Title	Laboratory Animal Sciences
Coordinator	Prof. Dr. M. Koch
Course(s)	1. Laboratory Animal Sciences
Type	1. Lecture 2. Exercises
Total Number of Hours per Semester & Course	1. 2 SWS 2. 2 SWS
Compulsory/ Elective	Compulsory
Study Programme	Master of Neurosciences
Duration	1. One week
Term	First semester (Winterterm)
Student Workload	CPs: 3
	Elaboration: a) Attendance: 40 hours b) Preparation / Revision: 20 hours c) Protocol/ Reading/ Exam: 30 hours
Prerequisites of Acceptance	Enrolled Graduate M. Sc. Students
Frequency	Annual
Language	English

Learning Objectives	In this module, students learn: Protection of Animals Act (German Tierschutzgesetz) Methods: Design, planning and data handling of animal experiments with special emphasis of the “Reduce Replace Refine” principle. Training in the handling and care of rodents, i.e. keeping and hygiene. Animal welfare aspects. Techniques of anaesthesia and euthanasia, tissue and blood sampling, application of substances, techniques of surgery, licensing requirements and methods of animal behavioural testing
Competency	Students learn Laboratory animal care and experimental methods according to the standards of the FELASA (Federation of Laboratory Animal Science Associations) Category B.
Forms of Examination / Course Achievements	Lab report (Protocol describing the techniques applied)
Literature	Tutorial-Script (and literature referenced therein)

Introductory week	

Title	Introductory week
Coordinator	Prof. Dr. M. Koch
Course(s)	Basic knowledge in the neurosciences (held in conjunction with the Advanced Studies 1 modules)
Type	Lectures / Tutorials
Total Number of Hours per Semester & Course	2 SWS
Compulsory/ Elective	Compulsory
Study Programme	Master of Neurosciences
Duration	One week
Term	Second semester (Summerterm)
Student Workload	CPs: 3
	Elaboration: a) Attendance: Lectures and Tutorials 28 hours Reading / follow-up: 62 hours
Prerequisites of Acceptance	Enrolled Graduate M. Sc. Students
Frequency	Annual
Language	English
Learning Objectives	The introductory week serves to welcome the students coming back from the semester break and introduce them briefly into basic knowledge necessary for the ensuing Advanced studies. They get an introduction into concepts of attention, optogenetics, scientific writing and literature search, statistics and experimental design and programming using Matlab.

Competency	Students learn or rehearse some of the basic methods that come to use in the following exercises
Forms of Examination / Course Achievements	None
Literature	Research papers and reviews

Module 406	
Title	Advanced Studies 1: Neuro- and Electrophysiology
Coordinator	Prof. Dr. Andreas Kreiter
Course(s)	Neuro- and Electrophysiology
Type	1. Seminar 2. Exercises
Total Number of Hours per Semester & Course	1. 2 SWS 2. 6 SWS
Compulsory/ Elective	Elective
Study Programme	Master of Neurosciences
Duration	Four weeks
Term	Second semester (Summerterm)
Student Workload	CPs: 9 Elaboration: Attendance: Seminar (Tutorial) and Exercises: 112 hours Data analysis, written report and exam preparation: 128 hours Literature studies: 30 hours
Prerequisites of Acceptance	Enrolled Graduate M. Sc. Students, certificate in Laboratory Animal Science required (usually successful attendance of module 415)
Frequency	Annual
Language	English
Learning Objectives	Students get introduced to current methods and procedures of systems neurophysiology (electrophysiology) and apply those by performing electrophysiological recordings from rat barrel cortex (Part I). Students also learn to analyze scientific data applying state-of-the-art methods as e.g. introduced in modules 403-1 and 414 (Part II).

Competency	In an introductory seminar students learn the physical and technical principles of electrophysiological recordings, usage of a stereotactic frame, surgical techniques, and neurophysiological basics of the studied brain circuitries. In the exercises, these methods are applied and reproduced to eventually perform electrophysiological recordings from rat barrel cortex. Here, students learn to responsibly plan and execute experiments and to process the collected data with different methods of analysis. Results of the exercises are summarized in a project report for Part I, and an oral presentation for Part II.
Forms of Examination / Course Achievements	Lab report, oral presentation/examination
Literature	Feldmeyer et al. 2013, Prog Neurobiol 103, 3 - 27 Fiorani et al. 2014, J Neurosci Meth 221, 112 - 126 Drebitz et al., 2019, Front Neurosci 13: 83.

Module 407	
Title	Advanced Studies 1: Neuropharmacology II
Coordinator	Prof. Dr. M. Koch
Course(s)	Behavioral Pharmacology of the Dopaminergic System
Type	1. Seminar 2. Exercises
Total Number of Hours per Semester & Course	1. 2 SWS 2. 6 SWS
Compulsory/ Elective	Elective
Study Programme	Master of Neurosciences
Duration	Four weeks
Term	Second semester (Summerterm)
Student Workload	CPs: 9
	Elaboration: Attendance: Seminar and Exercises: 112 hours Data analysis/Exam Preparation / Lab Report 118 hours Literature research: 40 hours
Prerequisites of Acceptance	Enrolled Graduate M. Sc. Students, successful participation in the modules 405 is necessary
Frequency	Annual
Language	English

Learning Objectives	Students will learn to perform stereotactic surgery (Implantation of microcannula into the striatum and into the nucleus accumbens) on rats. Students run various behavioral tests on motor activity and motivation (instrumental learning in the '*Skinnerbox*' and food preference tests) with rats. Microinfusions and systemic application of dopamine receptor agonists and antagonists in different doses elucidate the role of dopamine in behavioral control. Subsequently, histological and microscopical analysis of the brain tissue to localize injection sites, data analysis and statistics have to be performed.
Competency	Students learn the basic techniques and procedures of behavioral pharmacology (stereotactic surgery, systemic and intra-cerebral drug application) and to apply the acquired theoretical knowledge practically (i. e. experimental assessment of the relevance for the behavior of a neurotransmitter in the mammalian brain). They become acquainted with the planning of experiments and the handling of original data (collection, analysis and interpretation).
Forms of Examination / Course Achievements	Oral exam; Lab Report
Literature	Cooper, JR; Bloon FE; Roth, RH (2003) *The Biochemical Basis of Neuropharmacology*. 8. Ed., OUP. Koch, M; Schmidt, AS; Schnitzler, HU (2000) Role of the nucleus accumbens dopamine D1 and D2 receptors in instrumental and Pavlovian paradigms of conditional reward. Psychopharmacology 152: 67-73

Module 408	
Title	Advanced Studies 1: Optogenetics and Neuroscience methods
Coordinator	Prof Dr. O. Masseck
Course(s)	Optogenetics and Neuroscience methods
Type	1. Seminar 2. Exercises
Total Number of Hours per Semester & Course	1. 2 SWS 2. 6 SWS
Compulsory/ Elective	Elective
Study Programme	Master of Neurosciences
Duration	Four weeks
Term	Second semester (Summerterm)
Student Workload	CPs: 9
	Elaboration: Practical work and data analysis: 96 hours Written report and oral presentation: 36 hours Literature research: 12 hours
Prerequisites of Acceptance	Enrolled Graduate M. Sc. Students, successful participation in the modules 405 is necessary
Frequency	Annual
Language	English
Learning Objectives	Utilization of Molecular Biology techniques to design and construct optogenetic probes. Cell culture techniques to express and analyze proteins Microscopy techniques, such as FRET and Ca^{2+} Imaging. Design and performance of tracer and optogenetic experiments. Stereotactic surgery. Immunohistochemical stainings and analysis. Experimental design and investigation of different behaviors:

	anxiety, depression, object recognition, motor behaviour, decision making, spatial learning Formation and testing of hypotheses. Basics and logicals of scientific writing and oral presentations
Competency	Students will learn basic techniques for the development of optogenetic tools and acquire the knowledge to plan, perform and analyze optogenetic experiments. Students will gain knowledge of brain anatomy and neurotransmitter systems Students will learn to deal with experimental data in a critical and qualified way.
Forms of Examination / Course Achievements	Written protocol and oral presentation
Literature	A guide to optogenetic applications, with special focus on behavioral and in vivo electrophysiological experiments. In Handbook of In Vivo Neural Plasticity Techniques: A Systems Neuroscience Approach to the Neural Basis of Memory and Cognition. Book Chapter. Elsevier. Masseck OA, Spoida K, Herlitze S. (2015). Optogenetics. In Biotechnology. De Gruyter 1.Auflage 313-346. Book Chapter. Masseck OA, Mark MD, Herlitze S (2014) Use of Optogenetic Approaches to Control Intracellular Signaling of G Protein-Coupled Receptors. G-Protein Coupled Receptor Genetics. Methods in Pharmacology and Toxicology pp. 149-160. Springer Verlag Book Chapter. Masseck OA, Rubelowski JM, Spoida K, Herlitze S (2011). Light- and Drug-activated G-Protein coupled Receptors to Control intracellular Signaling . Exp. Physiol 96:51-6. Review. Selected, recent reviews

Module 410	
Title	Advanced Studies 1: Experimental Neuropsychology
Coordinator	Prof. Dr. Dr. M. Herrmann
Course(s)	Experimental Neuropsychology
Type	Lecture, Exercises, Lab-Course / Hands-on Training
Total Number of Hours per Semester & Course	8 SWS
Compulsory/ Elective	Elective
Study Programme	Master of Neurosciences
Duration	Four weeks
Term	Second semester (Summerterm)
Student Workload	CPs: 9
	Elaboration: Attendance 8 SWS Lectures .....42 hours Exercises 42 hours Lab-Course/Hands-on training 26 hours Literature research and reading 32 hours Data analysis, lab report, protocol and exam preparation 128 hours
Prerequisites of Acceptance	Enrolled Graduate M.Sc. Students
Frequency	Annual
Language	English

Learning Objectives	Students will acquire knowledge on experimental methods and procedures in cognitive neuropsychology. They will get introduced into strategies and planning of experimental designs, behavioral data assessment, (f)MRI and EEG methods. They will learn to operate a stimulation software package and to implement a behavioral experiment. Students will conduct a pilot study (or work with sample data) and analyze the respective data set with appropriate statistical means. They will present their study and discuss pitfalls and limitations of the respective experiment.
Competency	Students will be enabled to design, conduct, and analyze a research project in the field of experimental neuropsychology. They will get a basic knowledge about how to transfer a hypothesis into an experimental design, about where and when to use different experimental procedures (behavioral testing, EEG, fMRI), and how to derive valid conclusions from the data analysis.
Forms of Examination / Course Achievements	Protocol and written or oral presentation
Literature	Hugdahl, K. (Ed.) (2003). *Experimental Methods in Neuropsychology*. Series: Neuropsychology and Cognition, Vol. 21. Boston : Kluwer Academic Publishers

Module 411	
Title	Avanced Studies 1: Cognitive Psychology and EEG
Coordinator	Prof. Dr. Dr. Manfred Herrmann, Prof. Dr. Michael Koch
Course(s)	Cognitive Psychology and EEG
Type	1. Lecture 2. Exercise
Total Number of Hours per Semester & Course	1. 2 SWS 2. 4 SWS
Compulsory/ Elective	Elective
Study Programme	Master of Neurosciences
Duration	Four weeks
Term	Second semester (Summer term)
Student Workload	CPs: 9
	Elaboration: Attendance: Cognitive Psychology and Exercise 28 hours Exercise 50 hours Home studies (preparation, revision) 50 hours Reading 40 hours Data analysis 30 hours Protocols 36 hours Exam preparation 36 hours
Prerequisites of Acceptance	Enrolled Graduate M. Sc. Students
Frequency	Annual
Language	English

Learning Objectives	Cognitive functions of the brain Theoretical models for memory, perception, attention and thinking Combination of EEG and psychophysics Experimental design and performance of EEG experiments Analysis and interpretation of EEG-ERP-Data
Competency	Students will learn how to evaluate cognitive functions of the brain using EEG-measurements in combination with specific experimental paradigms. They will understand the concept of spontaneous and event-related activations of the brain. They will get an overview about the event-related potentials and event-related oscillations measured with the EEG and their possible functional correlates for different cognitive states. They will know how to conduct and analyze experiments in healthy participants and patients with psychiatric disorders. They will acquire basic knowledge for their subsequent lab-rotation and master thesis
Forms of Examination / Course Achievements	Oral exam, Lab Report
Literature	Handy, T.C. (Ed), 2004, Event-Related Potentials: A Methods Handbook. MIT Press Luck, S. J., 2005, An Introduction to the Event-Related Potential Technique (Cognitive Neuroscience). MIT-Press Saeid, S., Chambers, J.A. (2013), EEG Signal Processing Wiley-Interscience Selected current reviews

Module 412	
Title	Advanced Studies 1*:* Structural and Functional Neuroimaging
Coordinator	Prof. Dr. Dr. M. Herrmann
Course(s)	412a Functional Neuroimaging 412b Structural Neuroimaging
Type	Lecture, Exercises, Lab-Course / Hands-on Training
Total Number of Hours per Semester & Course	412a: 6 SWS 412b: 2 SWS
Compulsory/ Elective	Elective
Study Programme	Master of Neurosciences
Duration	Four weeks
Term	Second semester (Summerterm)
Student Workload	CPs: 9
	Elaboration: Attendance: Lectures 46 hours Exercises 56 hours Lab-Course/Hands-on training 26 hours Reading 32 hours Data analysis, lab report, protocol and exam preparation 110 hours
Prerequisites of Acceptance	Enrolled Graduate M.Sc. Students
Frequency	Annual
Language	English

Learning Objectives	Students will get introduced into the physical principles and experimental basics in MR imaging within the frame of cognitive neurosciences (412a). Following safety instructions and an introduction into the MR working environment, students conduct and analyze functional MRI measurements. They are encouraged to modify the experimental setting according to their own interests. Afterwards, the students work in small groups on one topic-specific data analysis and presentation to their colleagues. They will further (412b) get a brief introduction into structural imaging techniques and the description of MR and CAT scans using the appropriate terminology. Additionally, MR images with different slice orientation will be used to rehearse human brain anatomy.
Competency	412a: Students will be enabled to design, conduct, analyze, and present an fMRI experiment. They will be capable to comprehend the appropriate choice of MR and experimental design parameters relevant for the neuroscientific research topic. 412b: Students will present basic skills in describing brain lesions in MR- and CAT-scans using the appropriate technical terms. They will further be able to roughly assign brain abnormalities to human brain anatomy.
Forms of Examination / Course Achievements	Protocol or oral presentation / written exam (412a) and oral test (412b)
Literature	Cabeza, R. & Kingstone, A. (Eds.) (2006). *Handbook of Functional Neuroimaging of Cognition*. 2nd ed. Cambridge (MA): The MIT Press. Huettel, S.A. & Song, A.W. & McCarthy, G. (2004) *Functional Magnetic Resonance Imaging*. Sunderland (MA, USA): Sinauer Associates Inc. Zilles, K. & Rehkämper, G. (1998). *Funktionelle Neuroanatomie - Lehrbuch und Atlas*; 3rd ed. Berlin, Heidelberg, New York: Springer

Module 413

Title	Advanced Studies 1: Neurophysics
Coordinator	Prof. Dr. Klaus Pawelzik
Course(s)	Neurophysics
Type [3]	Lecture/Seminar/Exercises
Total Number of Hours per Semester & Course	8 SWS
Compulsory/ Elective	Elective
Study Programme	Master of Neurosciences
Duration	1 semester
Term	First summer term
Student Workload	CPs: 9
	Elaboration: Attendance 8 SWS Neurophysics 56 hours Data analysis and modelling 28 hours Home studies (preparation, revision) 84 hours Reading 42 hours Exam preparation 60 hours
Prerequisites of Acceptance	Modules 401-404, 414 and 415 passed
Frequency	Annual
Language	English

[3] **Lecture / Course / Tutorial or Lab Course / Project**

Learning Objectives	Advanced concepts and methods in Theoretical Neurosciences. Students will focus on a specific topic from this field, and pursue a mini research project on its key aspects. They may select from different topics, as e.g. (a) Collective dynamics in networks of recurrently coupled neurons (synchronizations and oscillations, feature integration, non-linear dynamics of elementary circuits). (b) Classification, computation and inference (spiking networks, sparse coding, Bayesian methods, machine learning)
Competency	Students will learn novel concepts and acquire advanced skills in Theoretical Neurosciences in a three-staged process mimicking real lab research (investigation, reproduction, exploration). Hereby they will develop the competency to... (a) ...select a specific topic of interest and become acquainted with the fundamental concepts and mathematical methods associated (through original literature and mini-lectures). (b) ...reproduce key results from the literature by performing a numerical simulation or mathematical analysis of a neural model. (c) ...extend their model and to systematically explore its behavior beyond published results.
Forms of Examination / Course Achievements	Report or program code, and presentation in a seminar
Literature	Up-to-date literature, journal articles, as well as the textbook: Dayan & Abbott, Theoretical Neurosciences, MIT Press 2005.

Module 501	
Title	Advanced Studies 2
Coordinator	Lecturers of the study program
Course(s)	Lab Rotation 1
Type	a. Seminar b. Lab Course (Internship)
Total Number of Hours per Semester & Course	a. 2 SWS b. 6 SWS
Compulsory/ Elective	Elective
Study Programme	Master of Neurosciences
Duration	0.5 semester
Term	Third semester (Winterterm)
Student Workload	CPs: 15
	Elaboration Attendance in the lab 280 hours Home studies (Reading, preparation, revision) 60 hours Data analysis 40 hours Report 40 hours Seminar preparation 30 hours
Prerequisites of Acceptance	Modules 401-404 and 414-415 passed
Frequency	Annual
Language	English

Learning Objectives	Advanced lab course in various disciplines of the neurosciences in a laboratory (clinic etc.) in Bremen or abroad (a list of institutions that hosted students in the past is attached, together with a letter that informs the hosts about the lab rotation) Preparation of a seminar talk and report
Competency	Students are able to organize an extended internship. They work relatively independent on a research topic. They learn data analysis, statistical evaluation and interpretation on an advanced level. They get acquainted with scientific writing and oral presentation.
Forms of Examination / Course Achievements	Oral presentation, written report
Literature	Selected, actual reviews and research papers related to the topic chosen

Module 502	
Title	Advanced Studies 2
Coordinator	Lecturers of the study program
Course(s)	Lab Rotation 2
Type	a. Seminar b. Lab Course (Internship)
Total Number of Hours per Semester & Course	a. 2 SWS b. 6 SWS
Compulsory/ Elective	Elective
Study Programme	Master of Neurosciences
Duration	0.5 semester
Term	Third semester (Winterterm)
Student Workload	CPs: 15
	Elaboration Attendance in the lab 280 hours Home studies (Reading, preparation, revision) 60 hours Data analysis 40 hours Report 40 hours Seminar preparation 30 hours
Prerequisites of Acceptance	Modules 401-404 and 414-415 passed
Frequency	Annual
Language	English

Learning Objectives	Advanced lab course in various disciplines of the neurosciences in a laboratory (clinic etc.) in Bremen or abroad (a list of institutions that hosted students in the past is attached, together with a letter that informs the hosts about the lab rotation) Preparation of a seminar talk and report
Competency	Students are able to organize an extended internship. They work relatively independent on a research topic. They learn data analysis, statistical evaluation and interpretation on an advanced level. They get acquainted with scientific writing and oral presentation.
Forms of Examination / Course Achievements	Oral presentation, written report
Literature	Selected, actual reviews and research papers related to the topic chosen

Module 503	
Title	MSc. Thesis and Colloquium / Supervisory Seminar
Coordinator	Lecturers of the study program
Course(s)	Subject specific research for the thesis in the different working groups of the neuroscience department Active attendance in the lab seminar of the different groups Thesis defence
Type	Thesis
Total Number of Hours per Semester & Course	14 SWS
Compulsory/ Elective	Compulsory
Study Programme	Master of Neurosciences
Duration	1 semester
Term	Fourth semester (Winterterm)
Student Workload	CPs: 30 (Thesis: 27CP, seminar: 3CP)
	Individual studies in a lab, thesis preparation and seminar: 900 h
Prerequisites of Acceptance	At least 60CP from first study year
Frequency	Annual
Language	English
Forms of Examination / Course Achievements	Oral presentation, written thesis, students participate in a supervisory lab seminar to discuss research data and/or research articles from the current literature

Qualification Profile of Lecturers

Name	**Dr. Udo Ernst**
Focus of teaching and research	Computational Neuroscience, Theoretical Physics, Programming and Data Analysis
Academic qualification	Studies in physics (University of Frankfurt) 1993 PhD (University of Frankfurt/ MPI Göttingen) 1999 Research associate (University of Bremen) 2000 Research group leader Bernstein Award (University of Bremen) since 2010
Research projects and collaborations	DFG Sonderforschungsbereiche 185 and 517, DFG Schwerpunktprogramm 1665, Bernstein Group Bremen, Bernstein Award Udo Ernst (BMBF) Cooperations with Prof. Dr. K. Pawelzik / Prof. Dr. A. Kreiter / Dr. D. Wegener (Bremen), Prof. Dr. S. Denève (Paris), Prof. Dr. M. Herzog (Lausanne), Dr. M. Persike and Prof. Dr. G. Meinhardt (Mainz)
Selected publications	Lisitsyn, D., & Ernst, U. A. (2019). Causally Investigating Cortical Dynamics and Signal Processing by Targeting Natural System Attractors With Precisely Timed (Electrical) Stimulation. Frontiers in Computational Neuroscience 13. Grothe, I., Rotermund, D., Neitzel, S. D., Mandon, S., Ernst, U. A., Kreiter, A. K., & Pawelzik, K. R. (2018). Attention selectively gates afferent signal transmission to area V4. *Journal of Neuroscience*, 38(14), 3441–3452. Ernst, U., Schiffer, A., Persike, M., & Meinhardt, G. (2016). Contextual interactions in grating plaid configurations are explained by natural image statistics and neural modeling. Frontiers in Systems Neuroscience, 10. https://doi.org/10.3389/fnsys.2016.00078 Ernst, Udo A., Mandon, S., Schinkel–Bielefeld, N., Neitzel, S. D., Kreiter, A. K., & Pawelzik, K. R. (2012). Opti-mality of human contour integration. PLoS Computational Biology, 8(5), e1002520. Lochmann, T., Ernst, U., & Deneve, S. (2012). Perceptual inference predicts contextual modulations of sensory responses. Journal of Neuroscience, 32(12), 4179–4195.
Miscellaneous	Member of the Steering Committee of the National Network in Computational Neuroscience Faculty Member in SmartStart training initiative in Computational Neuroscience

Name	**Dr. Peter Erhard**
Focus of teaching and research	Programming, fMRI, MRI-Hardware, peripheral Devices for MRI
Academic qualification	Promotion Basel 1994 PhD Biophysics University Diploma Biology and Pharmaceutical Biology 1990 Erlangen Student Research Assistent, MRI coil development, Siemens Erlangen 1987 - 1990 Post Doc University of Minnesota 1994-1998 Head of Research Group fMRI, Klinikum rechts der Isar, TU Munich (1998-2003) Postdoctoral Research Fellow University of Bremen (2003 – now) Researcher, Fraunhofer Institute MEVIS (2016 – now)
Research projects and collaborations	EC Funded I.Family (Germany, Hungary, Sweden, Netherlands) Zukunftstechnologie Metamaterialien (Fraunhofer FHR, Fraunhofer MEVIS) A Staniloiu, Bielefeld University of Bucharest H Markowitsch, University of Bielefeld B Godde, Jacobs Universty Bremen T Hortobágyi, University of Groningen TF Münte, Universität Lübeck M Günther, FB01, Universität Bremen W Lang, FB01, Universität Bremen
Selected Publications	Hoinkiss DC, P Erhard P, M Günther, NV Breutigam, F von Samson-Himmelstjerna, DA Porter: Prospective Motion Correction in Functional MRI using Simultaneous Multislice Imaging and Multislice-to-Volume Image Registration, submitted to Neuroimage Perlaki G, D Molnar, PAM Smeets, W Ahrens, M Wolters, G Eiben, L Lissner, P Erhard, FV Meer, M Herrmann, J Janszky, G Orsi: I.Family Consortium: Volumetric gray matter measures of amygdala and accumbens in childhood overweight/obesity.PLoS One 18, https://doi.org/10.1371/journal.pone.0205331 (2018) Godde B, M Trautmann, P Erhard, C Voelcker-Rehage: Motor practice in a force modulation task in young and middle-aged adults. J Electromyogr Kinesiol. 38: 224-231 (2018) Papegaaij S, T Hortobágyi, B Godde, WA Kaan, P Erhard, C Voelcker-Rehage: Neural correlates of motor-cognitive dual-tasking in young and old adults. PloS One 17 (2017) Wiswede D, S Taubner, A Buchheim, TF Münte, M Stasch, M Cierpka, H Kächele, G Roth, P Erhard, H Kessler H: Tracking functional brain changes in patients with depression under psychodynamic psychotherapy using individualized stimuli. PloS One 9 (2014)
Miscellaneous	Reviewer: Biomedical_Physics_Engineering_Express, Journal of Neural Engineering

Name	**Privatdozent Dr. rer. soc. Dipl.-Psych. Thorsten Fehr**
Focus of teaching and research	Biological Psychology, Neuropsychology, Cognitive Neuroscience, Clinical Psychology, Methods (functional Neuroimaging and Biosignalanalyses [EEG/MEG]) / Neuroscience on Different Topics Related to Complex Cognition and Emotion
Academic career and qualification	Studies in Psychology, Konstanz University (1990-1996) PhD Dr. rer.soc. (Psychophysiology/Psychology) at Konstanz University (2001) Habilitation (venia legendi in Psychology) at Bremen University (2008) Research Associate, Dpt. Clinical Psychology, Konstanz University (1996-2002) Postdoctoral Research Fellow and teaching staff at Dept. Neuropsychology/Behav. Neurobiol, Bremen University and Dept. Neurology II, University Hospital, Magdeburg University (2002-2006) Postdoctoral Research Fellow and teaching staff at Dept. Neuropsychology/Behav. Neurobiol. Bremen University (2006-2007) Research Associate and teaching staff (Dr.habil.) at Dept. Neuropsychology/Behav. Neurobiol., Bremen University (Center for Cognitive Sciences), and Private Lecturer (Faculty 11), Bremen University (2008-now)
Research projects and collaborations	Cooperation with Research-Groups from the SFB 1330 (EASE, as Co-PI), e.g., AG Schultz, AG Schill, AG Beetz Cooperation with Reseach-Groups from the Bremen „Zentrum für Entscheidungsforschung (ZEF, as Founding member)“, e.g., AG Döbereiner, AG Borchert Dr. Patrizia Milz & Prof. Roberto Pascual-Marqui: The KEY Institute for Brain Mind Research, University Hospital of Psychiatry, Zurich Prof. Carlos Alois-Ferrer: University of Zürich (UoC Forum - Motivation, Self-Control, and Economic Behavior; Decision Theory and Neuroeconomics) Prof. Anja Achtziger Zeppelin University, FN, Germany Prof. Chris Code: Univ. of Sydney / Univ. of Exeter (UK)
Selected publications	Fehr, T., Staniloiu, A., Markowitsch, H. J., Erhard, P., & Herrmann, M. (2018). Neural correlates of free recall of "famous events" in a "hypermnestic" individual as compared to an age- and education-matched reference group. Biomedical Central Neuroscience, doi:10.1186/s12868-018-0435-y. Fehr, T. & Herrmann, M. (2015). Can modular psychological concepts like affect and emotion be assigned to a distinct subset of regional neural circuits? Comment on "The Quartet Theory of Human Emotions: An Integrative and Neurofunctional model" by S. Koelsch et al. Physics of Life Reviews, 13, 47-49. Fehr, T. (2013). A hybrid model for the neural representation of complex mental processing in the human brain. *Cognitive Neurodynamics*, 7, 89-103.

	Fehr, T. (2012). Neuronale Korrelate der Aggression beim Menschen - virtuelle Medien und reale Lebensumgebung. In: W. Kaminski & M. Lorber (Eds.), *Gamebased Learning*, München, kopaed. Fehr, T., Weber, J., Willmes, K. & Herrmann, M. (2010). Neural correlates in exceptional mental arithmetic - About the neural architecture of prodigious skills. *Neuropsychologia*, 48, 1407-1416. Amidzic, O., Riehle, H.J., Fehr, T. & Elbert, T. (2001). Focal gamma band activity: the signature of chunks in the expert memory of chess players. *Nature*, 412, 603.
Miscellaneous	Founding member of the „Zentrum für Entscheidungsforschung“ (ZEF) at Bremen University Co-PI in the SFB 1330 (EASE, Bremen University) Member of the Editorial Board of the international peer-reviewed methods journal “Cognitive Neurodynamics” International Scientific Media Work in Radio, Internet, and Television (scientific support and Interviews)

Name	**Prof. Dr.med. Dr.phil. Manfred Herrmann; Dipl.-Psych.**
Focus of teaching and research	Neuropsychology, Cognitive Neurosciences, Behavioral Neurology, Molecular Biology
Education / Academic Background	Habilitation Venia Legendi, Freiburg University, 1994 PhD Dr.med., Freiburg University, 1993 PhD Dr.phil. (Psychology), Freiburg University, 1988 MD Medical Licensing Examination, Freiburg University, 1993 Dipl.-Psych. (MA-equivalent), Freiburg University, 1985
Professional and Academic Training	Dissertation Scholarship (Landesgraduiertenförderungsgesetz (LGFG) Baden-Württemberg), 1986 -1988 Postdoctoral Scholarship (DFG), 1989 - 1992 Assistant Professor (C1), Physician and Neurologist in Training, Department of Neurology, Faculty of Medicine, Freiburg University,1993 – 1996 Board Examination, Certified Clinical Neuropsychologist (Society of Neuropsychology, GNP), 1995
Academia: Current Positions:	Chair, Professor (C4), Department of Neuropsychology and Behavioral Neurobiology, Bremen University, 2002 - present Scientific Director, Center for Advanced Imaging, Bremen University, 2008 - present Member; Price Board of Trustees, Fürst Donnersmarck-Foundation, Berlin, 2005 - present Deputy Director, Center for Cognitive Sciences, Bremen University, 2014 - present Board and Chairperson, Fellow-HWK Alumni Association, Hanse Institute for Advanced Study, 2005 - present Board of Directors „Center for Advanced Imaging“ (CAI), Bremen/ Magdeburg, 2003 - present

	Honorary Research Associate, Brain Damage & Communication Research Centre, University of Sydney, Australia, 1997 - present
Academia: Past Positions:	Vice Dean / Research Dean, Faculty of Human and Health Sciences, Bremen University, 2015-2018 Invited Visiting Professor, Cluster of Excellence “Languages of Emotion”, Berlin, Free University, 2010 Invited Fellow, Hanse Institute for Advanced Study (HWK), 2000-2001 Director, Associate Professor (C2), Section of Neuropsychology, Faculty of Medicine, University of Magdeburg, 1996-2000 Invited Visiting Professor (NHMRC), Brain Damage & Communication Research Centre, University of Sydney, Australia, 1997 Research Fellow (DFG), Institute of Neurological Research Raul Carréa, Buenos Aires, Argentina, 1996 Secretary, Collaborative Research Focus "Neuropsychology and Neurolinguistics", University of Freiburg, 1993-1996
Editor / Board Member	Zeitschrift für Neuropsychologie, Zeitschrift für Neurolinguistik, Aphasiology, Acta Neuropsychologica, Frontiers in Neuroscience, Psychology, Neurology and Psychiatry, Restorative Neurology and Neuroscience (Guest Editor)
Distinguished Award	„Deutsche Gesellschaft für Neurotraumatologie und klinische Neuropsychologie“ (DM 10.000), 1993
(International) Scientific Cooperations and Funding	• „Univ. of Sydney / Univ. of Exeter (UK): Prof. Chris Code • Univ. of Barcelona: Prof. Carles Escera • Univ. of East Anglia (UK): Prof. Kenny Coventry • MIT / Cambridge (USA) Prof. Kenneth Wexler • MPI für Experimentelle Medizin Göttingen: Prof. Ehrenreich • Univ. Lübeck: Prof. Thomas Münte • Free Univ. Berlin: Prof. Art Jacobs • Karlsruhe Institute of Technology: Prof. Christof Weinhardt Extramural Funding: DFG, SFB (3), BMBF, EU, HBFG, NHMRC, Σ ~ 6.500 k€
Publications	Scopus: 113 peer-reviewed original paper, H= 34; N = 3946 cits.

Name	**Prof. Dr. rer. nat. Michael Koch**
Focus of teaching and research	Neurobiology, Neuropharmacology, Behavioral Neuroscience
Academic career and qualification	Studies in biology and chemistry (University of Konstanz) 1985 PhD (University of Konstanz) 1990 Research associate and habilitation (University of Tübingen) 1996 Professor of Neuropharmacology (University of Bremen) since 2000

Research projects and collaborations	Formerly PI in DFG Sonderforschungsbereich 517 and Schwerpunktprogramm 1001 Cooperations with Prof. Dr. M. Fendt (Uni Magdeburg), Prof. Dr. R. Schwarting (Uni. Marburg), Prof. Dr. Ralf Dringen (Uni Bremen)
Selected Publications	Gundelach J, M Koch: Redirection of neuroblasts from the rostral migratory stream into a lesion in the prefrontal cortex of adult rats. Exp Brain Res 236: 1181-1191 (2018) Wischhof L, M Koch: 5-HT2A and mGlu2/3 receptor interactions: on their relevance to cognitive function and psychosis, Behav Pharmacol 27: 1-11 (2016) Hayn L, Koch M: Suppression of excitotoxicity and foreign body response by memantine in chronic cannula implantation into the rat brain. Brain Res Bull 117: 54-68 (2015) Wischhof L, E Irrsack, F Dietz, M Koch: Maternal liposaccharide treatment differentially affects 5-HT2A and mGlu2/3 receptor function in the adult male and female offspring. Neuropharmacology 97: 275-288 (2015) Feja M, M Koch: Frontostriatal circuits comprising connections between ventral medial prefrontal cortex and nucleus accumbens subregions differentially regulate impulse control in rats. Psychopharmacology 232: 1291-1302 (2015)
Miscellaneous	Advisory editor: Psychopharmacology (2000-2008) Handling editor: Journal of Neurochemistry (since 2011) Advisory editor: Naunyn-Schmiedeberg's Archives of Pharmacology (since 2016 Member of the executive committee of the German Neuroscience Society and spokesman of the section Neuropharmacology and –toxicology (2013-2017)

Name	**Prof. Dr. rer. nat. Andreas K. Kreiter**
Focus of teaching and research	Animal physiology and neurobiology, Systemic and cognitive neurobiology
Academic career and qualification	Study of Biology at the Eberhard-Karls-University in Tübingen (1982 – 1987) Diploma thesis at the Max Planck Institute for Biological Cybernetics, Tübingen (1988) PhD at University of Tübingen / Max Planck Institute for Brain Research, Frankfurt/Main, Prof. Dr. Wolf Singer (1989-1992) Research fellowship at the Max Planck Institute for Brain Research, Frankfurt/Main (1992-1993) Research associate at the Max Planck Institute for Brain Research, Frankfurt/Main (1993-1997) Professor at the Brain Research Institute, University of Bremen since 1997

Research projects and collaborations	HFSP: Oscillatory Event-Related Brain Dynamics. 1995-1998 EU-Commission: Neural substrate of visual induced 40Hz synchronized activity: a joint study in humans and the awake monkey. 1997-1998 Member of DFG SFB 517: Neural Basis of Cognitive Functions. Project A7: The Influence of Selective Visual Attention on Temporal Coordination of Neural Responses. 1997-2005 Volkswagenstiftung: Neuronal Mechanisms of Gestalt Perception. 2000-2004 DFG: Neuronal mechanisms of behaviour-dependent visual processing in cortical areas MT and V1/2 of the macaque. 2006-2012 BMBF: Bernstein Partner: Functional Adaptation of the visual cortex. Project 3: Adaptive routing of information flow in the visual cortex. 2007-2011 BMBF/DLR: Cordless detection of local field potentials and electrical stimulation of the cortex for medical diagnostics and neuroprosthetics. 2009 -2013 BMBF/Bernsteinpreis Dr. Udo Ernst, Cooperation project: "Neuronal mechanisms of rapid functional configuration". 2012 - 2017 Tönjes Vagt Stiftung, in cooperation with Dr. D. Wegener: A key for locked-in patients: communication by means of attention-modulated brain signals. 2014-2018 DFG SPP 1665: Interareal phase coherence as a mechanism for attention-dependent neuronal signal routing: A model-guided causal analysis using new, multi-contact floating silicon probes for intracortical chronic stimulation and recording in primates. 2013-2020 DFG: Following neuronal signals of multiple visual stimuli through cortical pathways to identify attentional gating mechanisms. 2017-2020 **Collaborations:** Prof. Dr. Alexa Riehle, Institut de Neurosciences Cognitives de la Méditerranée (INCM), Marseille, France Prof. Dr. Thomas Stieglitz, IMTEK, Lehrstuhl für Biomedizinische Mikrotechnik, Universität Freiburg Prof. Dr. Walter Lang, IMSAS, Universität Bremen Prof. Dr. Steffen Paul, ITEM, Universität Bremen
Selected publications	Drebitz E, Haag M, Grothe I, Mandon S, Kreiter AK (2018) Attention configures synchronization within local neuronal networks for processing of the behaviorally relevant stimulus. Frontiers in Neural Circuits 12. https://www.frontiersin.org/article/10.3389/fncir.2018.00071/full Grothe I, Rotermund D, Neitzel SD, Mandon S, Ernst UA, Kreiter AK, Pawelzik KR (2018) Attention Selectively Gates Afferent Signal Transmission to Area V4. The Journal of Neuroscience 38:3441–3452.

	Galashan FO, Saßen HC, Kreiter AK, Wegener D (2013). Monkey area MT latencies to speed changes depend on attention and correlate with behavioral reaction times, Neuron 78: 740-750. Rotermund D, Ernst UA, Mandon S, Taylor K, Smiyukha Y, Kreiter AK, and Pawelzik KR (2013) Toward high performance, weakly invasive brain computer interfaces using selective visual attention. J Neurosci. 2013 Apr 3; 33(14):6001-11. Grothe I, Neitzel S, Mandon S, Kreiter, AK, (2012) Switching neuronal inputs by differential modulations of gamma-band phase-coherence. J Neurosci 32(46):16172 – 16180.
Miscellaneous	Reviewer for international magazines: Science, BMC Biology, Cerebral Cortex, Communications Biology, Current Biology, European Journal of Neuroscience, Frontiers, Journal of Neural Engineering, Journal of Neurophysiology, Journal of Neuroscience, Journal of Neuroscience Methods, Nature Communications, Neural Computation, Neuro Image, PLOS Biology Reviewer for organizations: DFG, BMBF, EU, Agence Nationale de la Recherche, Humboldt-Stiftung, The German Israeli Foundation (GIF), Volkswagen-Stiftung, Wissenschaftliche Kommission Niedersachsen, DPZ, Studienstiftung des Deutschen Volkes, Boehringer Ingelheim Fonds

Name	**Dr. phil. Ekkehard Küstermann**
Focus of teaching and research	in-vivo MR-Spectroscopy and –Tomography, functional metabolic imaging and spectroscopy
Academic career and qualification	PhD Biophysics, University of Basel 1996 Diploma Biology II, University of Basel 1988-1992 Postdoc Biozentrum University of Basel July to Oct. 1996 Postdoc: Massachussetts General Hospital, NMR-Center, Charlestown/Boston, USA 1996-1998 Research Assistant (Postdoc): University of Nottingham, Magnetic Resonance Centre, UK 1998-2000 Postdoc Researcher Max-Planck-Institut für Neurologische Forschung, Köln 2000-2003 Postdoc Researcher at Bremen University since 2003
Selected publications	Adapted MR velocimetry of slow liquid flow in porous media." Huang L, Mikolajczyk G, Küstermann E, Wilhelm M, Odenbach S, Dreher W. J Magn Reson. 276:103-112 (2017) Manganese-mediated MRI signals correlate with functional β-cell mass during diabetes progression." Meyer A, Stolz K, Dreher W, Bergemann J, Holebasavanahalli Thimmashetty V, Lueschen N, Azizi Z, Khobragade V, Maedler K, Kuestermann E. Diabetes 64(6):2138-2147 (2015) Hemorrhage in mouse tumors induced by dodecaborate cluster lipids intended for boron neutron capture therapy." Schaffran T, Jiang N, Bergmann M, Küstermann E, Süss R, Schubert R, Wagner FM, Awad D, Gabel D. Int J Nanomedicine 9:3583-3590 (2014)

	Neural correlates of social motivation: an fMRI study on power versus affiliation." Quirin M, Meyer F, Heise N, Kuhl J, Küstermann E, Strüber D, Cacioppo JT. Int J Psychophysiol. 88(3):289-95 (2013) Monitoring of implanted stem cell migration in vivo: a highly resolved in vivo magnetic resonance imaging investigation of experimental stroke in rat." Hoehn M, Küstermann E, Blunk J, Wiedermann D, Trapp T, Wecker S, Föcking M, Arnold H, Hescheler J, Fleischmann BK, Schwindt W, Bührle C. PNAS 99(25):16267-72 (2002)

Name	**Prof. Dr. Olivia Masseck**
Focus of teaching and research	Neuroscience, Optogenetics, Behavior and neuromodulatory systems
Academic career and qualification	2000 - 2004 1. Staatsexamen in Biology and Mathematics, Ruhr University Bochum (RUB) 2008 PhD in Neuroscience, International Graduate School of Neuroscience, RUB 10/2008-08/2009 Postdoctoral researcher Department of General Zoology & Neurobiology, RUB 08/2009-12/2009 Postdoctoral researcher Laboratoire de Neurobiologie des Reseaux Sensorimoteurs, Université Paris Descartes, France, *research fellowship DFG* 12/2009-11/2012 Postdoctoral researcher Department of General Zoology & Neurobiology, RUB 11/2012 Principal Investigator Department of General Zoology & Neurobiology, RUB 05/2016 – 09/2018 Assistant professor “Advanced Fluorescence Microscopy” RUB Since 10/2018 Professor for “Synthetic Biology” University of Bremen
Research projects and collaborations	DFG “Control and understanding of 5-$HT_{1A/B}$ signaling pathways and their involvement in anxiety behavior” SFB 874 ”Integration and representation of sensory processes” Subproject B12: Mechanisms underlying changes in hippocampal information processing by neuromodulation. DFG “A genetically encoded 5-HT sensor to investigate 5-HT pathways” <u>Collaborations with</u> Deniz Dalkara, Adeno associated viruses, Institute de la vision, Paris, France Evan Deneris, 5-HT system, Department of Neurosciences, Case Western Reserve University, USA Martin Fuhrmann, 2-photon Imaging, Spine analysis, Center for Neurodegenerative Diseases, Bonn, Germany Ingrid Ehrlich, Anxiety, Amygdala, Department of Neurobiology, University Stuttgart Onur Güntürkün, Optogenetics in avian species, Department of

	Biopsychology, Ruhr University Bochum, Germany Sonja Kleinlogel, Optogenetics, Department of Physiology, University Bern Denise Manahan-Vaughn, Plasticity and Learning, Hippocampus, Department of Neurophysiology,Ruhr University Bochum, Germany Klaus Nave, Nex-cre mice, Neurogenetics, Max Planck Institute Experimentelle Medizin
Selected publications	Berg L, Eckhardt J, Masseck OA (2019). Enhanced activity of pyramidal neurons in the infralimbic cortex drives anxiety behavior. PLoS One 14(1): e0210949. https://doi.org/10.1371/journal.pone.0210949 Spoida K, Eickelbeck D, Karapinar R, Eckhardt T, Mark MD, Jancke D, Ehinger BV, König P, Dalkara D, Herlitze S, Masseck OA (2016). Melanopsin Variants as Intrinsic Optogenetic On and Off Switches for Transient versus Sustained Activation of G Protein Pathways. Curr Biol. 2016 May 9; 26(9):1206-12. doi: 10.1016/j.cub.2016.03.007. Epub 2016 Apr 7.PMID: 27068418 Lux V, Masseck OA, Herlitze S, Sauvage M. (2015) .Optogenetic destabilization of the memory trace in CA1: insights into reconsolidation and retrieval processes. Cerebral Cortex Jan 1;27(1):841-851. doi: 10.1093/cercor/bhv282. Spoida K, Masseck OA, Deneris ES, Herlitze S. (2014) Gq/5-HT2c receptor signals activate a local GABAergic inhibitory feedback circuit to modulate serotonergic firing and anxiety in mice. Proc Natl Acad Sci U S A 111(17):6479-84. Masseck OA, Spoida K, Dalkara D, Maejima T, Rubelwoski JM, Wallhorn L, Deneris ES, Herlitze S. (2014) Vertebrate cone opsins enable sustained and highly sensitive rapid control of $G_{i/o}$ signaling in anxiety circuitry. Neuron 81 (6): 1263-1273.
Miscellaneous	Reviewer for the DFG Board member SFB 874

Name	**PD Dr. Birgit Mathes**
Focus of teaching and research	Cognitive Neuroscience, Neurodevelopment, Schizophrenia
Academic career and qualification	since 2017 Head of Research Lab 2016 Habilitation 2006 PhD (University of Bremen, summa cum laude) since 2003 Researcher at the University of Bremen 2002/03 Neuropsychiatry Centre der University of Melbourne 2002 Diploma in Psychology
Research projects and collaborations	BRISE – Bremer Initiative zur Stärkung frühkindlicher Entwicklung (BMBF)

Selected publications	AS Wienke, C Basar-Eroglu, C Schmiedt-Fehr & B Mathes (2018). Novelty N2-P3a complex and theta oscillations reflect improving neural coordination within frontal brain networks during adolescence, Frontiers in Behavioral Neuroscience, 12 (218), 1-13, doi: 10.3389/fnbeh.2018.00218 B Mathes, K Khalaidovski, AS Wienke, C Schmiedt-Fehr & C Basar-Eroglu (2016). Maturation of the P3 and concurrent oscillatory processes during early and late adolescence, Clinical Neurophysiology,127, 2599-609 B Mathes, C Schmiedt-Fehr, S Kedilaya, D Strüber, A Brand & C Basar-Eroglu (2016). Theta response in schizophrenia is indifferent to perceptual illusion, Clinical Neurophysiology, 127: 419-30 M Koch, C Schmiedt-Fehr & B Mathes (2016). Neuropharmacology of altered brain oscillations in schizophrenia. International Journal of Psychophysiology, 103, 62-8 C Basar-Eroglu, B Mathes, K Khalaidovski, A Brand & C Schmiedt-Fehr (2016). Altered alpha brain oscillations during multistable perception in schizophrenia. International Journal of Psychophysiology, 103, 118-28

Name	**Prof. Dr. Klaus Pawelzik**
Focus of teaching and research	Theoretical Physics/Theoretical Biophysics, Complex Adaptive Systems, Neurophysics
Academic career and qualification	Study of Physics at the University of Frankfurt 1980-1987 PhD at the University of Kiel 1987-1990 Scholarship at the MPI for Brain Research in Frankfurt 1991 Postdoctoral Researcher at the Institute for Theoretical Physics, University of Frankfurt 1991-1996 Postdoctoral Researcher at the Salk Institute, La Jolla 1994-1995 Postdoctoral Researcher at the MPI for Fluid Dynamics in Göttingen 1996-1998 Professor at the Institute for Theoretical Physics, University of Bremen since April 1998 Research visits in Santa Barbara, at the Weizmann Institute in Israel und at the ENS (École Normale Superieure) in Paris
Research projects and collaborations	Member of „Sonderforschungsbereich“ 185 „Nonlinear Dynamics“ 1991-1999 und SFB 517 „Neurocognition“ 1999-2005 DIP (German-Israelian Project Coordination) Metacomp (BMBF) Jan. 2002-Dec. 2007 BMBF National Network Computational Neuroscience, Bernstein Partner „Functional adaptation of the visual cortex“ 2007-2010 Bernstein Innovation Competition 2007 promoting medical technique (Cooperation with Brain Products and Prof. Elger, Bonn) Bernstein Focus “Neuronal Basis of Learning” Extreme events, „Perception in Science and Society“The Financial Market Sewsaw”, VolkswagenStiftung

	Dynamic instabilities from information annihilation in neuronal networks and human motor control, DFG Cooperations: Weizmann Institute of Science, Rehovot, Israel ENS Ecole Normale Supérieure, Paris, France Mc Gill University, Montreal, Canada
Selected publications	Ernst UA, Mandon S, Schinkel-Bielefeld N, Neitzel SD, Kreiter A, Pawelzik KR. 2012. Optimality of human contour integration. PLOS Computational Biology. 8 (5):e1002520. Patzelt F, Pawelzik KR. 2011. Criticality of Adaptive Control Dynamics. Physical Review Letters. 107(23):238103. Rotermund D, Ernst UA, Taylor K, Pawelzik KR, Kreiter AK. 2009. Attention Improves Object Representation in Visual Cortical Field Potentials. Journal of Neuroscience. 29 (32):10120–10130. Harnack, D., Laminski, E., Schünemann, M. & Pawelzik, K. (2017) Topological causality in dynamical systems. Physical Review Letters 119, 098301 Grothe, I., Rotermund, D., Neitzel, S. D., Mandon, S., Ernst, U. A., Kreiter, A. K. & Pawelzik (2018) K. R. Attention selectively gates afferent signal transmission to area V4. The Journal of Neuroscience 38 (14), 3441-3452
Miscellaneous	Managing Director of the Center for Cognitive Sciences Member of the Animal Experimentation Commission

Name	**Dr. rer. nat. Detlef Wegener**
Focus of teaching and research	Systems neuroscience, Neurophysiology and psychophysics of visual attention
Academic career and qualification	Right to award doctorates: University of Bremen 2017 P.I. University of Bremen, 2013 Research fellow Max-Planck Institute for Biological Cybernetics, Tübingen 2012 Lecturer for animal physiology, University of Applied Science Bremen, 2003-2007 Dr rer. nat,, University of Bremen 2003 Dipl. Biol., University of Bremen 1997 Studies in biology and life sciences, Glasgow/UK & Bremen
Research projects and collaborations	Project leader and responsible head of several DFG-funded research projects (2006 to today) Project leader of several third-party grants (CRDF University of Bremen, Tönjes Vagt Foundation, German Academic Scholarship Foundation) Member of DFG Collaborative Research Centre 517 (1998 – 2004)
Selected publications	Drebitz E, Schledde B, Kreiter AK, Wegener D (2019). “Optimizing the yield of multi-unit activity by including the entire spiking activity”, Frontiers in Neuroscience 13: 83.

	Fischer B, Wegener D (2018). “Emphasizing the ‘positive’ in positive reinforcement: Using non-binary rewarding for training monkeys on cognitive tasks”, Journal of Neurophysiology 120: 115-128. Schledde B, Galashan FO, Przybyla M, Kreiter AK, Wegener D (2017). “Task-specific, dimension-based attentional shaping of motion processing in monkey area MT”, Journal of Neurophysiology 118: 1542-1555. Gledhill D, Grimsen C, Fahle M, Wegener D (2015). “Human feature-based attention consists of two spatiotemporally distinct processes“, Journal of Vision 15(8): 1-17. Galashan FO, Saßen HC, Kreiter AK, Wegener D (2013). “Monkey area MT latencies to speed changes depend on attention and correlate with behavioral reaction times”, Neuron 78: 740-750.
Miscellaneous	Animal Care Officer University of Bremen Animal Care Officer Leibniz Institute for Marine Research Liaison Lecturer Hans-Böckler Foundation Expert Reviewer for Journal of Neuroscience, Journal of Neurophysiology, Nature Scientific Reports, and several others Organiser 36th European Conference on Visual Perception 2013 (with U. Ernst and C. Grimsen)